


recorded. The data are shown. At $\alpha = 0.05$, can the claim be rejected? Assume $\sigma = 7.71$. (8-2)

97	94	96	105	99
96	80	95	101	97
101	87	88	97	94
98	95	88	94	94
99	99	98	96	96
97	98	99	92	97
99	108	97	98	114
91	96	102	99	102
100	93	88	102	99
98	80	95	101	61

Source: *The World Almanac & Book of Facts*.

- 2. Travel Times to Work** Based on information from the U.S. Census Bureau, the mean travel time to work in minutes for all workers 16 years old and older was 25.3 minutes. A large company with offices in several states randomly sampled 100 of its workers to ascertain their commuting times. The sample mean was 23.9 minutes, and the population standard deviation is 6.39 minutes. At the 0.01 level of significance can it be concluded that the mean commuting time is less for this particular company? (8-2)

Source: factfinder.census.gov

-  **3. Debt of College Graduates** A random sample of the average debt (in dollars) at graduation from 30 of the top 100 public colleges and universities is listed below. Is there sufficient evidence at $\alpha = 0.01$ to conclude that the population mean debt at graduation is less than \$18,000? Assume $\sigma = 2605$. (8-2)

16,012	15,784	16,597	18,105	12,665	14,734
17,225	16,953	15,309	15,297	14,437	14,835
13,607	13,374	19,410	18,385	22,312	16,656
20,142	17,821	12,701	22,400	15,730	17,673
18,978	13,661	12,580	14,392	16,000	15,176

Source: www.Kiplinger.com

- 4. Time Until Indigestion Relief** An advertisement claims that Fasto Stomach Calm will provide relief from indigestion in less than 10 minutes. For a test of the claim, 35 individuals were given the product; the average time until relief was 9.25 minutes. From past studies, the standard deviation of the population is known to be 2 minutes. Can you conclude that the claim is justified? Find the P -value and let $\alpha = 0.05$. (8-2)
- 5. Monthly Home Rent** The average monthly rent for a one-bedroom home in San Francisco is \$1229. A random sample of 15 one-bedroom homes about 15 miles outside of San Francisco had a mean rent of \$1350. The population standard deviation is \$250. At $\alpha = 0.05$, can we conclude that the monthly rent outside San Francisco differs from that in the city? (8-2)

Source: *New York Times Almanac*.

- 6. Salaries for Actuaries** Nationwide, the average salary of actuaries who achieve the rank of Fellow is \$150,000.


An insurance executive wants to see how this compares with Fellows within his company. He checks the salaries of eight Fellows and finds the average salary to be \$155,500 with a standard deviation of \$15,000. Can he conclude that Fellows in his company make more than the national average, using $\alpha = 0.05$? (8-3)

Source: BeAnActuary.org

- 7. Weights of Men's Soccer Shoes** Is lighter better? A random sample of men's soccer shoes from an international catalog had the following weights (in ounces).

10.8	9.8	8.8	9.6	9.9
10	8.4	9.6	10	9.4
9.8	9.4	9.8		

At $\alpha = 0.05$ can it be concluded that the average weight is less than 10 ounces? (8-3)

-  **8. Whooping Crane Eggs** Once down to about 15, the world's only wild flock of whooping cranes now numbers a record 237 birds in its Texas Coastal Bend wintering ground (www.SunHerald.com). The average whooping crane egg weighs 208 grams. A new batch of eggs was recently weighed, and their weights are listed below. At $\alpha = 0.01$, is there sufficient evidence to conclude that the weight is greater than 208 grams? (8-3)

210	208.5	211.6	212	210.3
210.2	209	206.4	209.7	

Source: <http://www.pwrc.usgs.gov/cranes.htm>

- 9. Union Membership** Nationwide 13.7% of employed wage and salary workers are union members (down from 20.1% in 1983). A random sample of 300 local wage and salary workers showed that 50 belonged to a union. At $\alpha = 0.05$, is there sufficient evidence to conclude that the proportion of union membership differs from 13.7%? (8-4)

Source: *Time Almanac*.

- 10. Federal Prison Populations** Nationally 60.2% of federal prisoners are serving time for drug offenses. A warden feels that in his prison the percentage is even higher. He surveys 400 inmates' records and finds that 260 of the inmates are drug offenders. At $\alpha = 0.05$, is he correct? (8-4)

Source: *New York Times Almanac*.

- 11. Free School Lunches** It has been reported that 59.3% of U.S. school lunches served are free or at a reduced price. A random sample of 300 children in a large metropolitan area indicated that 156 of them received lunch free or at a reduced price. At the 0.01 level of significance, is there sufficient evidence to conclude that the proportion is less than 59.3%? (8-4)

Source: www.fns.usda.gov

- 12. MP3 Ownership** An MP3 manufacturer claims that 65% of teenagers 13 to 16 years old have their own MP3 player. A researcher wishes to test the claim and selects a random sample of 80 teenagers. She finds that 57

Critical Thinking Challenges

The power of a test ($1 - \beta$) can be calculated when a specific value of the mean is hypothesized in the alternative hypothesis; for example, let $H_0: \mu = 50$ and let $H_1: \mu = 52$. To find the power of a test, it is necessary to find the value of β . This can be done by the following steps:

- Step 1** For a specific value of α find the corresponding value of \bar{X} , using $z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$, where μ is the hypothesized value given in H_0 . Use a right-tailed test.
- Step 2** Using the value of \bar{X} found in step 1 and the value of μ in the alternative hypothesis,

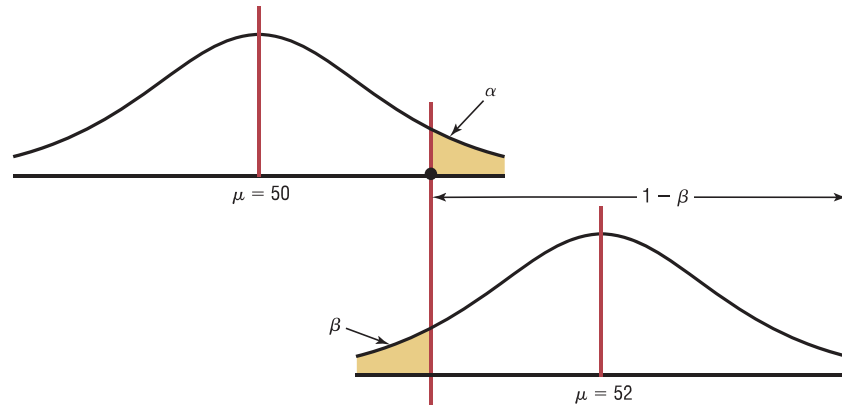
find the area corresponding to z in the formula $z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$.

- Step 3** Subtract this area from 0.5000. This is the value of β .

- Step 4** Subtract the value of β from 1. This will give you the power of a test. See Figure 8–42.

1. Find the power of a test, using the hypotheses given previously and $\alpha = 0.05$, $\sigma = 3$, and $n = 30$.
2. Select several other values for μ in H_1 and compute the power of the test. Generalize the results.

Figure 8–42
Relationship Among α , β , and the Power of a Test



Data Projects

Use a significance level of 0.05 for all tests below.

- 1. Business and Finance** Use the Dow Jones Industrial stocks in data project 1 of Chapter 7 as your data set. Find the gain or loss for each stock over the last quarter. Test the claim that the mean is that the stocks broke even (no gain or loss indicates a mean of 0).
- 2. Sports and Leisure** Use the most recent NFL season for your data. For each team, find the quarterback rating for the number one quarterback. Test the claim that the mean quarterback rating for a number one quarterback is more than 80.
- 3. Technology** Use your last month's itemized cell phone bill for your data. Determine the percentage of your text messages that were outgoing. Test the claim that a majority of your text messages were outgoing. Determine the mean, median, and standard deviation for the length of a call. Test the claim that the mean length

of a call is longer than the value for you found for the median length.

- 4. Health and Wellness** Use the data collected in data project 4 of Chapter 7 for this exercise. Test the claim that the mean body temperature is less than 98.6 degrees Fahrenheit.
- 5. Politics and Economics** Use the most recent results of the Presidential primary elections for both parties. Determine what percentage of voters in your state voted for the eventual Democratic nominee for President and what percentage voted for the eventual Republican nominee. Test the claim that a majority of your state favored the candidate who won the nomination for each party.
- 6. Your Class** Use the data collected in data project 6 of Chapter 7 for this exercise. Test the claim that the mean BMI for a student is more than 25.